

GEOGRAPHICAL NOTES

At the meeting of the Geographical Society on Monday evening, Sir H. Rawlinson read a letter just received from Mr. Thomson, the leader of the East African Expedition. Mr. Thomson wrote on November 9 from Pambete, at the south end of Lake Tanganyika, the shores of which he first reached on November 4, and he gives a brief account of his journey from the head of Lake Nyassa. After leaving the country of Konde, the party came on the steep face of the great African plateau, rising from 3,300 to 6,500 feet in the country of Nyika. At first they travelled over highlands at an elevation of 7,000 feet, the highest point reached being 8,180 feet on the Munboya range. The land then descends through a somewhat barren region to 3,300 feet, in about long. $32^{\circ} 45'$. On the west Nyika is bounded by the Chingambo Mountains, which have a precipitous eastern face, but a gradual slope away to the west. These mountains Mr. Thomson places in long $32^{\circ} 45'$, lat. $9^{\circ} 5'$. The rivulets of the Nyika region drain down to the Lukuviro, a few south, and others north-west to Lake Hikwa, a lake now heard of for the first time. Mr. Thomson, on the other side of the Chingambo Mountains, entered the small country of Inyamwanga, which appears to be covered almost entirely with forests, and slopes west to its boundary, the Mkaliza, a stream flowing south in about long. $32^{\circ} 20'$. Here the country of Mambwe was reached, consisting alternately of pasture and forest land, and rising to a height of 5,000 feet at Kitimba's capital. The same elevation continues through the hilly Ulungu country to Lake Tanganyika. Mr. Thomson also furnishes some notes as to the hydrography of Mambwe, the northern part of which is a great water-shed for streams. He was to proceed northwards on November 10, along the west side of the lake, and a telegram has been received from Dr. Kirk, stating that he had left Ujiji, on the eastern shore, on January 16, on his return to Uguha. If he had not already done so, he would then; no doubt, carry out his intention of examining the Lukuga Creek for thirty miles, and afterwards striking south through the still unexplored region in that quarter. Mr. Thomson will next pass between the two lakes again and reach the coast at Kilwa. After this very interesting piece of new geography, Lieut. G. F. Temple, R.N., read a paper descriptive of a voyage on the coasts of Norway and Lapland, undertaken chiefly in the interests of hydrography, and which appears to have had useful results.

THE St. Petersburg Society of Naturalists proposes to send an important expedition for the exploration of the fishing on the Murmanian coast, and of the fauna of the western parts of the White Sea. Several professors will take part in this expedition, which will be under the direction of Prof. Wagner.

THE Rev. Father Carrie, Superior of the Roman Catholic Mission to the Congo, writing from Landana on December 3 last, gives some information regarding Mr. Stanley's Congo Expedition. The *personnel* of Mr. Stanley, the Father writes, is very numerous; besides Mr. Stanley, there is a superintendent, an engineer, a captain, several mechanics, carpenters, &c., in all twenty whites of different nations—Belgians, Americans, English, Italians, Danes. The expedition has recently been joined by a French naturalist, M. Protche. Many of the Europeans had already succumbed to fever and the hardships of the work involved. The following of blacks consisted of about 100 men, Arabs or natives of Sierra Leone and the Congo. There are five small steamers and several other boats, carts, and other machinery for land transport, wooden houses ready to erect, &c. Father Carrie was taken by steamer to Noki, the last European settlement on the river. Thence in a canoe the Father was taken further up, to Vivi, the first station of Mr. Stanley's expedition, on the right bank of the river, about 130 miles from the coast. Four or five miles further up the first of the Yellala Cataracts is met with. When the Father arrived Mr. Stanley was away among the mountains in the direction of the great village of Vivi. M. van Schandel told the Father that Mr. Stanley set out on his excursions and returned without giving notice to any one. The traveller soon returned, "exhausted by fatigue and covered with dust and perspiration." While waiting the end of the rainy season, Mr. Stanley is solidly establishing himself in his first station, the basis of all future operations, and maturing his plans for overcoming the difficulties to be met with. These difficulties are so great that the Father thinks it will take years before the termination of the terrible chain of mountains can be reached and the second station established at Stanley Pool, 200 miles distant. Mr. Stanley's intention, we are told, is to ascend the

Congo to the Lualaba, where he hopes to find his Arab friend, Tibu Tib. Then he will explore the western part of the Congo, as well as the country on its two banks, attempting, at the same time, to attract the ivory trade to Mboma.

THE *Daily News* Lisbon correspondent telegraphs that Ivens and Capello, who have arrived at that city, have explored and studied a vast area and obtained important data for constructing a map of the province of Angola. They traversed the bush of Quioco, passed beyond the River Quango in the direction of Chicapa, and determined the roads to Muatay and Anvo, to the bush of Lobuco, Pesside, and Luba. They ascertained the sources of the rivers Quango, Cassai, and Loando, and descended the last-named to the seventh parallel. The Quango has extensive rapids. The sources of these rivers are contiguous. The explorers bring many observations—geographical, meteorological, and magnetic, and also on the African fauna and flora—and they will publish these observations.

WURSTER AND CO., of Zurich, the publishers of Kaltbrunner's "Manuel du Voyageur," noticed by us on its publication, request all interested in scientific geography, both societies and individuals, to forward a statement of any desiderata whereby the work would be improved as a manual of scientific instruction for travellers of all nationalities. Communications should be addressed to M. Kaltbrunner, Bureau International des Postes, Zurich.

MR. J. H. RILEY, one of the agents of the China Inland Mission at Chungking, in Szechuen, in company with Mr. Mollman, of the British and Foreign Bible Society, at the end of last July, paid a visit to Ngo-mi-Shan and the borders of the Lolo country. The mountain in question is one of the loftiest in the province, and is remarkable for its Buddhist temples; the travellers spent some days on it, and experienced a notable decrease in temperature, for, though they were there in mid-August, they found a fire necessary. From Ngo-mi they went westward to Ngo-pien-ting, about three or four miles from Tsuan-chi-kow, a small town on the boundary of the Lolo country, into which they were unable to penetrate owing to the opposition of the officials. They succeeded, however, in getting a Lolo to return with them, so that something will be learned about these people. The men are described as fine, stalwart fellows; they wear cloaks, some made of coarse woollen, with a fringe round the bottom, and some of a kind of felt. Mr. Riley returned to Chungking, by way of Kia-ting-fu, at the end of September.

IN the voluminous blue book on Central Asia, which has recently been published, will be found some information respecting the Akhal-Tekkes, drawn up by M. Kuropatkine. The Tekkes, as is known, are divided into two parts, the one, the Akhal-Tekke, inhabiting the oasis at the foot of the Kurendagh, and the other the oasis of Merv. The former oasis is 150 versts in length, and 20 versts in breadth, containing about 30,000 *Kibitkas*, half of which are at Geok-Tépé, practically the capital of the race. The tribe is sub-divided into Takhtamystchis and Utemystchis, the former being three times the more numerous, as well as the more peaceable. The eastern villages, from Varodji to Hiaurs, are governed by four Khans. Beum, where the Utemystchis live, is on the west, and is ruled by a Tykma-Sirdar. The Takhtamystchis settlements are under the authority of Berdi Muvgad Khan, son of the powerful Nura Verdi Khan.

THE March number of *Ptermann's Mittheilungen* contains the conclusion of Dr. Junker's account of his fruitful travels to the west of the White Nile. This is followed by a paper by Dr. Lehmann, of Halle, on the recent Danish attempts to penetrate into the interior of Greenland, to which we have referred; maps accompany both these papers. The "Geographical Necrology" of 1879 is a long list, and is followed by an interesting memoir of the late J. E. Wappaeus, by Prof. H. Wagner, of Königsberg. The monthly notes contain, as usual, many valuable items of geographical information.

THE German *savant*, Herr Karl Bock, who was commissioned by the Dutch Government to investigate the southern and eastern districts of Borneo, has just completed his first tour in the eastern part of Koti.

NEWS just received announces the arrival at Kassala of the two German African travellers, Dr. Mook and Baron Holzhausen. They crossed the desert from Suakin to Kassala in fourteen days. Kassala, the residence of a pacha, is the centre

of the German dealers in wild beasts. Many German travellers originally started from here on their tours, such as Florian, Werner, Cohn, Dr. Schweinfurth, Heuglin. Dr. Mook and Baron Holzhausen intend to move in a south-easterly direction towards the Rahat and Diuder.

THE German Government has supported African research with the sums of 100,000 marks (5,000*l.*) during 1878, and 70,000 marks (3,500*l.*) during 1879. For the present year it is proposed to devote another sum of 70,000 marks to this purpose, besides a sum of 5,000 marks (250*l.*) for the furtherance of independent private research in the Dark Continent.

THE Paris Municipal Council has held a secret sitting to deliberate upon the organisation of a great banquet to Prof. Nordenskjöld. It has been decided that a gold medal be presented to the explorer in the Salle des États.

THE municipal authorities of Gossensass, on the Brenner Railway, have re-christened the Hünerspiel peak, famous for the magnificent view which is obtained from its summit, and which lies within their district. The peak will henceforth be called Amthorpeak, in honour of Dr. E. Amthor, of Gera, an eminent "Alpine" writer.

ON THE INFLUENCE OF ELECTRIC LIGHT UPON VEGETATION AND ON CERTAIN PHYSICAL PRINCIPLES INVOLVED^{*}

THE vast development of vegetation proves that dissociation is accomplished freely within the leaf-cells of plants, in which both water and carbonic acid are broken up in order that chlorophyll, starch, and cellulose may be formed. It is well known that this reaction depends upon solar radiation; but the question may fairly be asked whether it is confined to that agency, or whether other sources of light and heat, which, in common with the sun, exceed the temperature of dissociation, may not be called into requisition, in order to continue the action of growth, when that great luminary has set or is hidden behind clouds?

About two years ago I mentioned to Sir Joseph Hooker, then President of the Royal Society, that I thought the electric arc might be found sufficiently powerful to promote vegetation and that I should be willing to undertake some experiments on the subject if he could give me any hope of confirmative results. Sir Joseph Hooker gave me sufficient encouragement to induce me to follow up the subject, and I have since that time gradually matured a plan for conducting the experiment.

The apparatus which has been put up at Sherwood consists—
1. Of a vertical Siemens dynamo-machine, weighing 50 kilos, with a wire resistance of 0.717 unit on the electro-magnets. This machine makes 1,000 revolutions a minute, it takes 2 horse-power to drive it, and develops a current of 25 to 27 webers of an intensity of 70 volts. 2. A regulator or lamp constructed for continuous currents, with two carbon electrodes of 12 millims. and 10 millims. diameter respectively. The light produced is equal to 1,400 candles measured photometrically. 3. A motor, which at present is a 3 horse-power Otto gas engine, but which it is intended to supersede by a turbine to be worked by a natural supply of water, at a distance of about half a mile from the house.

My object in making these experiments was to ascertain whether electric light exercised any decided effect upon the growth of plants. For this purpose I placed the regulator in a lamp with a metallic reflector, in the open air, about two metres above the glass of a sunk melon house. A considerable number of pots were provided, sown and planted with quick-growing seeds and plants, such as mustard, carrots, swedes, beans, cucumbers, and melons. The plants could then be brought at suitable intervals under the influence of daylight and electric light, without moving them, both falling upon them approximately at the same angle. The pots were divided into four groups.

1. One pot of each group was kept entirely in the dark.
2. One was exposed to the influence of the electric light only.
3. One was exposed to the influence of daylight only.
4. One was exposed successively to both day and electric light.

The electric light was supplied for six hours, from 5 to 11

^{*} Abstract of a paper read at the Royal Society on March 4, by C. William Siemens, D.C.L., F.R.S.

each evening, all the plants being left in darkness during the remainder of the night.

In all cases the differences of effect were unmistakable. The plants kept in the dark were pale yellow, thin in the stalk, and soon died. Those exposed to electric light only showed a light-green leaf, and had sufficient vigour to survive. Those exposed to daylight only were of a darker green and greater vigour. Those exposed to both sources of light showed a decided superiority in vigour over all the others, and the green of the leaf was of a dark rich hue.

It must be remembered that, in this contest of electric against solar light, the time of exposure was in favour of the latter in the proportion of nearly two to one, but all allowance made, daylight appeared to be about twice as effective as electric light. It was evident, however, that the electric light was not well placed for giving out its power advantageously. The nights being cold, and the plants under experiment for the most part of a character to require a hot moist atmosphere, the glass was covered very thickly with moisture, which greatly obstructed the action of the light, besides which, the electric light had to pass through the glass of its own lamp.¹ Notwithstanding these drawbacks, electric light was clearly sufficiently powerful to form chlorophyll and its derivatives in the plants.

These preliminary trials go to prove that electric light can be utilised in aid of solar light by placing it over greenhouses, but the loss of effect in such cases must be considerable. I, therefore, directed my observations, in the next place, to the effect of electric light upon plants, when both were placed in the same apartment. The plants under experiment were divided into three groups; one group was exposed to daylight alone, a second similar group was exposed to electric light during eleven hours of the night, and were kept in the dark chamber during the day time, and the third similar group was exposed to eleven hours' day and eleven hours' electric light. These experiments were continued during four days and nights consecutively, and the results observed are of a very striking and decisive character, as regards the behaviour of such quick-growing plants as mustard, carrots, &c. The plants that had been exposed to daylight alone (comprising a fair proportion of sunlight) presented their usually healthy green appearance; those exposed to electric light alone were, in most instances, of a somewhat lighter, but, in one instance, of a somewhat darker hue than those exposed to daylight; and all the plants that had the double benefit of day and electric light far surpassed the others in darkness of green and vigorous appearance generally. A pot of tulip buds was placed in this electric stove, and the flowers were observed to open completely after two hours' exposure.

Although the access of stove heat was virtually stopped, the temperature of the house was maintained throughout the night at 72° F., proving that the electric lamp furnished not only a supply of effective light, but of stove heat also. No hurtful effect was, moreover, observed on the plants from the want of ventilation, and it would appear probable that the supply of pure carbonic acid resulting from the complete combustion of the carbonic electrodes at high temperature, and under the influence of an excess of oxygen, sufficed to sustain their vital functions. If the nitrogenous compounds which Prof. Dewar has shown to be developed in the electric arc were produced in large quantities, injurious effects upon the plants must undoubtedly ensue, but it can be shown that in a well-conditioned electric lamp, with a free circulation of air round the carbon electrodes, the amount of these products is exceedingly small, and of a different nature than is produced in a confined space.

These experiments are not only instructive in proving the sufficiency of electric light alone to promote vegetation, but they also go to prove the important fact that diurnal repose is not necessary for the life of plants, although the duration of the experiments is too limited perhaps to furnish that proof in an absolute manner. It may, however, be argued from analogy, that such repose is not necessary, seeing that crops grow and ripen in a wonderfully short space of time in the northern regions of Sweden and Norway, and Finland, where the summer does not exceed two months, during which period the sun scarcely sets.

The next step in the course of these experiments was to remove the electric lamp into a palm house, constructed of framed glass, which was 28 feet 3 in. long, 14 feet 6 in. wide, and averaging

¹ Prof. Stokes has shown, in 1857, that the electric arc is particularly rich in highly refrangible invisible rays, a circumstance which seems to point to a great loss on passing those rays through glass.